09/700,473

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT NO.: 6,797,335 B1

PATENTEE: PADEROV ET AL-1 PCT (RCE) ISSUED: SEPT. 28, 2004

SERIAL NO.: 09/700,473 FILED: JUNE 5, 2001

TITLE: METHOD FOR DEPOSITION OF WEAR-RESISTANT COATINGS AND FOR INCREASING THE LIFE SPAN OF PARTS

REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 C.F.R. 1.322 and 1.323

ATTN: Certificate of Correction
Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In accordance with the provisions of 37 C.F.R. 1.322 and 1.323 of the Rules of Practice, which implement 35 U.S.C. 254 and 255, approval of the attached Certificate of Correction for the above-identified patent to correct the errors noted below appearing in the issued patent is respectfully requested.

Most recently, in reviewing the above-identified patent, it was discovered that typographical errors appeared regarding the inventorship, in Figures 3 and 6, in the Summary of the Invention, and in Claims 1 and 13, which should be corrected.

In particular:

On the cover page, item [76], please change the first name of the first-named inventor from "Anatol y" to correctly read:

--Anatoly--.

On the cover page, item [76], please change the last name of the second-named inventor from "Ve Xler" to correctly read: --Veksler--.

In Figure 3, in the description, please change the word "dack" to correctly read: --back--.

In Figure 3, in the chart on the left hand side, in the Y axis, please change the word "yeild" to correctly read: --yield--.

In Figure 6, on the chart on the left hand side, along the X axis, in the abscissa, please change "25" to correctly read: --0,25--.

In Column 1, line 26, after the word "the" (first occurrence), please change the word "fill" to correctly read: --full--.

In Column 6, line 56, after the word "the", please change the word "fill" to correctly read: --full--.

In Column 10, line 33, (Line 31 of Claim 1), please insert a comma after the word "first".

In Column 12, line 27, (Line 15 of Claim 13), please insert a comma after the word "first".

Except for the inventorship, the Claims, and Figure 3, which were the fault of the Applicant, the errors were the fault of the PTO, as attested to by the attached excerpts from the Amendment in Response to the First Office Action dated December 27, 2002, and Figure 6 as filed on November 15, 2000. Enclosed herewith is a check for $100.00 to cover the amount of the petition fee. Please charge any additional fees or credit any overpayment to Deposit

Account No. 03-2468.

Accordingly, approval of the attached Certificate of Correction is respectfully requested.

Respectfully submitted,

ANATOLY PADEROV

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Allison C. Collard, Reg. No. 22,532
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Roslyn, New York 11576
(516) 365-9802

Enclosures: Certificate of Correction in duplicate
Excerpt from the Amendment in Response to the First Office Action dated December 27, 2002.
Figure 6 as filed on November 15, 2000.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: MAIL STOP Petition-Certificate of Corrections, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on December 28, 2004.

Maria Guastella

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PTO/SB/44 (04-04)
Approved for use through 04/30/2007. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,797,335 B1
DATED : SEPTEMBER 28, 2004
INVENTOR(S) : PADEROV ET AL-1 PCT (RCE)

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MAILING ADDRESS OF SENDER:

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ROSLYN, NY 11576

PATENT NO. 6,797,335

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6 JAN 2005

PTO/SB/44 (04-04)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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The microlayer may be an essentially discrete layer distinct from the adjacent substrate or microlayers; or it may be a mixture therewith. Each of the microlayers may comprise a pure metal or an alloy thereof as prepared, for example, if more than one metallic cathode are simultaneously activated within the chamber or the cathodes are made of alloys. The order of the plurality of microlayers can be selected by opting between corresponding gas atmospheres in the working chamber and by activating the appropriate cathode(s). The number and order of microlayers constituting the full coating and the inert or non-inert gas ions deposition can be selected depending on the specific requirements determined by the desired performances of machine parts or the whole machine. For example, it is essential that guide blades of the aircraft engine compressor had very hard and wear resistant surfaces, and at the same time fatigue characteristics of the substrate alloy would not play a restrictive role, since such blades are not subjected to high fatigue. On the contrary, working blades of the compressor are very sensitive to fatigue conditions as such blades have to operate under considerable fatigue stresses. Therefore, coatings designed for guide and working blades differ in their thickness and number of microlayers.

The method claimed involves deposition of, at least, three functional microlayers:

1 - a damping, corrosion-resistant microlayer of a rare earth metal from the Groups IVB - VIB or a replacement alloy based on said metals, deposited in inert gas atmosphere to the desired thickness, preferably 0.02 - 5 microns, that provides relaxation of erosion-caused stresses between solid layers and protects from corrosion-aggressive agents of media;

2 - a reinforcing microlayer consisting of interstitial solid solutions of nitrogen, boron, carbon in transition metals of the second layer, deposited to the desired thickness, preferably 0.04 - 10 microns, in a non-inert gas (nitrogen, diborane, methane, or acetylene, respectively, at a partial pressure of said gases 0.05 - $5x10^{-1}$Pa) atmosphere, that provides a gradual transition to a high strength layer;

3 - a wear-resistant, high strength microlayer consisting of interstitial phases such as nitrides, borides, carbides or complex compounds thereof based on said transition metals, deposited to the desired thickness, preferably 0.1 - 12.5 microns, in corresponding non-inert gas atmospheres at a partial pressure of $0.1 - 5 \times 10^{-1}$ Pa, that provides resistance to erosion effects of abrasive particles.

argon atmosphere. A temperature of the cathode up to 700°C was achieved over this stage. Then a titanium microlayer having a thickness of 1-2 microns was deposited under a nitrogen and argon atmosphere in the working chamber. Then pressure was increased and a microlayer of titanium nitride was formed of a thickness approximately 2 - 4 microns. The temperature of blades was maintained within 480 - 550°C over the whole deposition process to prevent any phase transformation in the bulk material.

The titanium cathode was inactivated and zirconium cathode heated to the same temperature by the same current density and potential difference as for the preceding titanium deposition step. During the deposition of titanium nitride and zirconium nitride there was nitrogen implantation carried out. The aforesaid deposition steps were repeated several times in the same sequence in order to obtain the desired thickness of the coating.

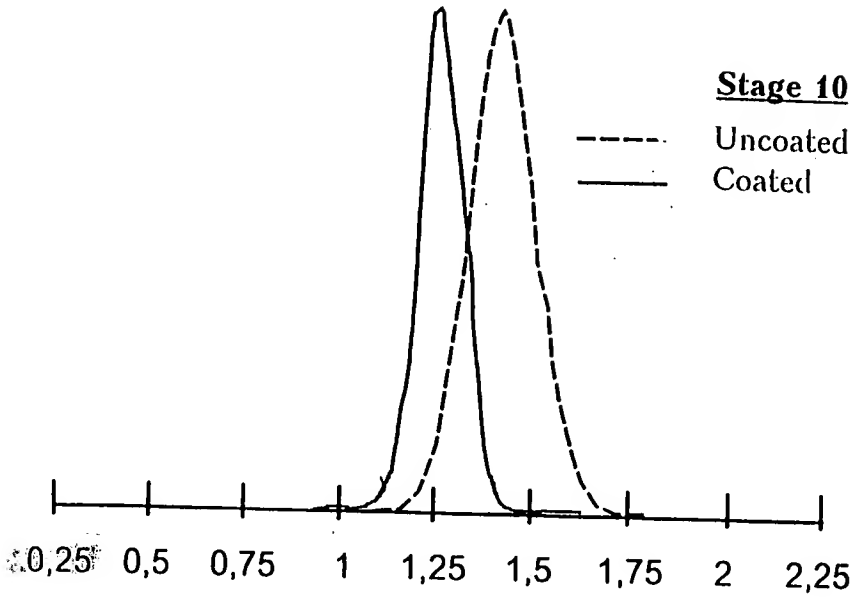
In alternative embodiments the foregoing titanium and zirconium ion deposition steps may be repeated, substituted or interchanged with titanium nitride and/or zirconium nitride ion deposition steps carried out under a nitrogen atmosphere. Interchanging of different microlayers is provided by the alternating heating of the titanium or zirconium cathodes under an argon or nitrogen atmosphere. An example is shown in Fig. 3 of changes in composition of various microlayers of the coating deposited following the claimed method and analyzed by means of the Rutherford back scattering. Clearly, a desired total thickness of coating can be obtained from a plurality of microlayers, preferably 3 - 20.

In preferred embodiments, each or some of the microlayers of the full coating at different stages in its preparation may be subjected to high energy ions of argon, nitrogen, carbon, or boron as selected by control of the atmosphere in the ion implantor under a potential difference between the ion-implantor electrode and the blades of 10 - 50 kV.

Ion implantors are well-known in the art.

In the present embodiment, the ion implantor of "Pulsar" type is provided with a low pressure arc between a screened cathode spot and a widened anode part of the discharge. The arc provides a high current of non-metallic ions of argon or a non-inert gas medium injected into the implantor from the developed emission surface of the anode plasma. Cathode ion emission is negligible since the cathode is not heated. Further, on screening of the cathode spot prevents its interference with the anode

Fatigue test results obtained
on compressor blades with and without coating



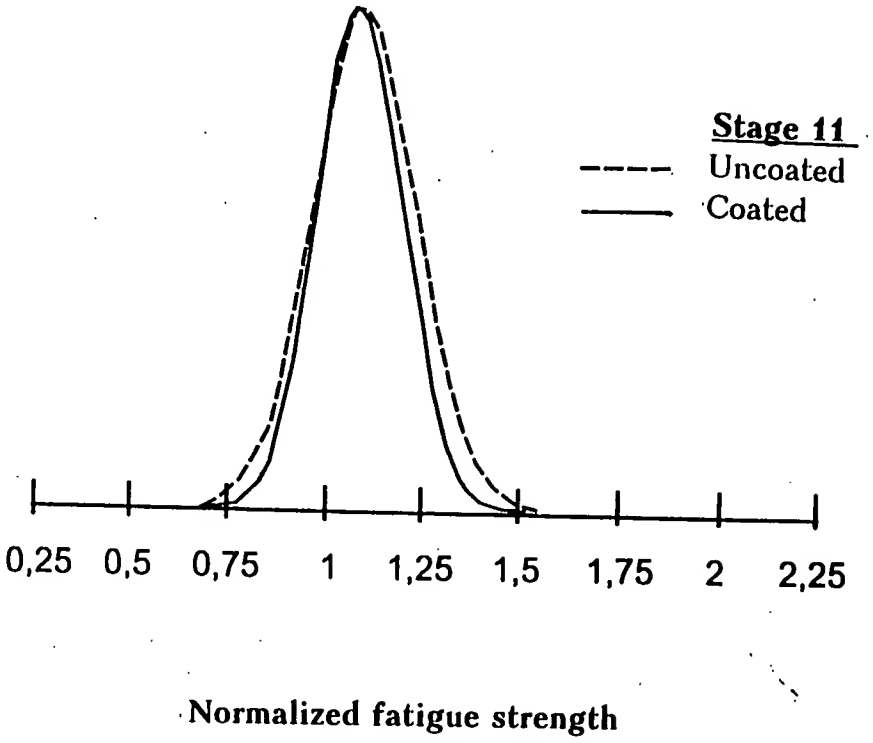


Fig. 6